air-gap between the second rotor and stator of the installed machine and is loosely held in place i.e. not firmly gripped or sandwiched by the second rotor **104***b* and second side of stator **102**.

[0100] FIG. **11** shows the machine **100** in its assembled, but uninstalled form, when using a second type of spacer **122'**. In the assembled, but uninstalled, form, the machine is provided in a condition in which the machine may be transported, but in which the machine **100** will not run.

[0101] With reference to FIGS. **9** to **12**, which have the same reference numerals for the corresponding features in the earlier figures, the machine **100** is provided having rotors **104***a,b* mounted to the shaft **106** at the respective rotor contact surfaces **130***a,b*. Also used in the assembly process (described below) is a spacer **122'**, which is provided to separate the first rotor **104***a* and the stator **102** and to prevent the stator **102** contacting and grounding on the first rotor **104***a* during transit (since the stator **102** is not fixed to any structure to prevent movement during transit). The spacer **122'** is attached to both the first rotor **104***a* and the stator housing **120** to minimise any relative motion between the two components during transit.

[0102] Method of Assembling the Machine

[0103] The YASA (Yokeless And Segmented Armature) machine **100** has a single annular stator **102** on either side of which there lies rotors **104***a,b* with permanent magnets **118***a,b* arranged with north and south poles lying parallel to the rotation axis, interacting with armature pole pieces across air gaps, one for each rotor and stator side. This arrangement balances the considerable attractive force of permanent magnet rotors towards the stator and the stator thereby receives a net attraction of close to zero. It is usual for rotor bearings to be closely associated with the motor, often within the stator such that the only load path from the rotor(s) is through the bearing held within the inner peripheral housing of the stator, which is an advantageous format that minimises stack up tolerances. In some instances left and right-hand rotor shrouds may house bearings and in either of these formats rotors are assembled on to a stator using jacking rigs to carefully control approach and placement so as to maintain the designed air-gap. Such motors when built are self-contained and may be shipped and assembled in to equipment with only the normal regard for whole motor axial alignment and motor handling.

[0104] In general the assembly of permanent magnet dynamo electric machines whether axial or of radial topology is a challenging task and requires careful consideration of how rotors and stator should be brought together so as not to damage these components and certainly to avoid touch-down of rotor on stator.

[0105] The following methods of assembly take special advantage of the unique topology of a single stator, double rotor axial flux machine enabling a simple and elegant assembly method, however with simple adjustment the assembly method may be applied to a single rotor, single stator topology.

[0106] With reference to FIGS. **5** to **8**, a right-hand rotor **104***a* of generally annular shape with a first and second side, the first side carrying permanent magnets **118***a* arranged in a clockwise fashion is attached to a rotor shaft **106** at the rotor contact surface **130***a*.

[0107] With the right hand rotor **104***a* in place, a first type of spacer **122** is then applied to the permanent magnet face of the right-hand rotor **104***a*. Such spacer **122** may be a single component annular disc with keyhole shaped central aperture to allow removal by radial movement (see for example FIG. **7**), or it may be multi-component pieces placed to provide uniform support to the rotor.

[0108] Advantageously the spacer may be marginally ferromagnetic so as to be held lightly in position when placed on the rotor carrying permanent magnets. The spacer **122** is of thickness just short (~100 microns) of the nominal stator **102** to rotor **104***a* airgap.

[0109] Having placed spacer **122** thereby protecting the rotor **104***a* from touch down by the stator **102**, an annular stator **102** having a central aperture larger than the diameter of the rotor shaft **106** is jacked into place, the annular stator **102** being allowed to approach and then contact the spacer **122**, which protects the right-hand rotor **104***a*. The spacer is firmly compressed by the stator to rotor attractive force; the spacer is made of a suitable material to fully support and not damage either the stator or the rotor.

[0110] With stator **102** and right-hand rotor **104***a* in place firmly sandwiching the spacer **122**, which separates the rotor **104***a* and stator **102** from touching just short of the nominal airgap distance, the left-hand rotor **104***b* is jacked towards the stator **102** and is attached fixedly to the rotor shaft **106** at the second rotor contact surface **130***b*. The first and second rotor contact surfaces **130***a,b* on the rotor shaft **106** are of axial separation to accept the stator **102** and provide nominal air gaps between stator **102** and first and second rotors **104***a,b*.

[0111] In this format the stator is biased towards the right-hand rotor **104***a* and the left hand rotor **104***b* to stator **102** airgap is as much above nominal as the right-hand rotor to stator air-gap is below nominal. For shipping purposes to avoid the potential of jump of stator to left-hand rotor a second spacer **124** (FIG. **8**) may be placed in the above nominal airgap.

[0112] The machine **100** is thus in its assembled form and suitable for transporting. Although, as described above, this machine is not in a condition to run in this form.

[0113] The assembly method of the stator **102** (not described) delivers a narrow and known tolerance on stator width such that from motor to motor a small and acceptable variation in physical air gap occurs when a stator is sandwiched between right and left-hand rotors. At this stage, it remains for the stator **102** to be centered between the rotors **104***a,b* to give an equal air gap between stator and either rotor, and for bearings to be provided to enable the rotors **104***a,b* to be able to rotate relative to the stator **102**.

[0114] With reference to FIGS. **9** to **13**, a right-hand rotor **104***a* of generally annular shape with a first and second side, the first side carrying permanent magnets **118***a* arranged in a clockwise fashion is attached to a rotor shaft **106** at the rotor contact surface **130***a*.

[0115] With the right hand rotor **104***a* in place, a second type of spacer **122'** is then attached to the second side of the first rotor **104***a*, that is to the side of the first rotor that faces away from the stator **102**. The spacer **122'** is formed as an annulus comprising a plurality of spacing portions **150** extending radially from the outer circumference of the annulus beyond the circumferential edge of the first rotor **104***a*. The spacing portions **150** also extend axially towards the stator **102**. The spacer **122'** is attached to the rotor **104***a* by, for example, a plurality of spacer bolts **152**. Other attachment means may be possible.